UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2008/2009

April/May 2009

EAH 422/4 – Advanced Water Resources Engineering
[Kejuruteraan Sumber Air Lanjutan]

Duration: 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **ELEVEN (11)** printed pages including appendix before you begin the examination.
*[Sila pastikan kertas peperiksaan ini mengandungi **SEBELAS (11)** muka surat bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.]*

Instructions: This paper consists of **FIVE (5)** questions. Answer **FOUR (4)** questions only. All questions carry the same marks.

*[**Arahan**: Kertas ini mengandungi **LIMA (5)** soalan. Jawab **EMPAT (4)** soalan sahaja. Semua soalan membawa jumlah markah yang sama.]*

You may answer the question either in Bahasa Malaysia or English.
[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

All questions **MUST BE** answered on a new page.
*[Semua soalan **MESTILAH** dijawab pada muka surat baru.]*

Write the answered question numbers on the cover sheet of the answer script.
[Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.]

…2/-

1. a) Define or briefly describe the following :-
   i) Irrigation
   ii) Quality of irrigation Water
   iii) Water requirement of crops
   iv) Advantages of Irrigation

[8 Marks]

b) The monthly consumptive use value for Paddy are tabulated in Table 1. Determine the consumptive use. What is the average monthly consumptive use and the peak monthly consumptive use?

Table 1

Dates	Rice C_u in cm
June 1-30	26.69
July 1-12	8.76
July 13-31	14.38
August 1-31	22.73
September 1-30	21.29
October 1-31	25.50
November 1-24	15.06

[9 Marks]

c) What are the possible causes of water losses in the canal irrigation system? What are the methods adopted for reducing such losses?

[8 Marks]

…3/-

2. A residential bungalow is proposed in Tanjung Bungah, Penang. The area of the site is 900m^2, an above-ground storage will be provided in the lawn area at the front of the site. The storage will be excavated into the lawn and a brick retaining wall constructed along the front and side boundary of the site. The primary outlet will be an orifice and secondary outlet consists of broad crested weir slot in the retaining wall. The site condition before development was park lawn. The surface runoff flows into the OSD via perimeter drain within the site consists as follows :-

Dwelling	= 300 m^2
Garage	= 45 m^2
Driveway	= 45 m^2
Surface Paving and paths	= 55 m^2
Lawns and Garden	= 455 m^2

To meet the requirement for water quantity control, determine the following:

i) Peak discharge for predevelopment condition
ii) Peak discharge for post development condition
iii) Permissible site discharge (PSD)
iv) Volume of OSD required.

Note: Based the OSD by assuming t_c = 45 minutes, t_{cs} = 30 minutes, t_d = 30 minute, C_d = 0.62 and C_{BCW} = 1.70.

[25 Marks]

3. a) Briefly describe **THREE (3)** types of storage consists as follows: on-site detention; community pond; and regional pond.

[5 Marks]

b) Discuss the concept of MSMA on the aspect of water quantity control and water quality control.

[10 Marks]

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c) Post development time-area curve and design rainfall (50 yr ARI) for area with 20 hectare and time of concentration 30 min (for post development condition) are given in table below. Derive the post development hydrograph for the developed area.

[10 Marks]

Design Rainfall Isohyet (50 year ARI)

Time (min)	Rainfall (mm)	Losses (mm)
5	18.0	5.0
10	25.0	2.5
15	30.0	2.5
20	32.5	2.5
25	20.0	2.5
30	16.0	2.5

Time-area Curve (Cumulative Area)

Area (m^2)	Time (min)
26000	5
56000	10
106000	15
146000	20
176000	25
200000	30

4. a) Discuss the goals of water resource planning

[5 Marks]

b) Describe the following water resources planning terms;
i) Goals and objectives
ii) Policies
iii) Principles
iv) Standards
v) Guidelines

[5 Marks]

c) With the aid of diagrams, what is meant by water resources management especially for water supply?

[5 Marks]

d) Discuss the role of water quality modeling in water resources.

[5 Marks]

e) In a water resource project, the feasibility study is important to evaluate the project alternatives. Describe the important features of a feasibility study report.

[5 Marks]

5. Given the following characteristics:-

Q	= 96 m^3/s	Z	= 2 m
D_{50}	= 40 mm	S_0	= 2.06 x 10^{-3}
θ	= 37^0	V_c	= 1.8 m/s

Assume K = 0.67, design a trapezoidal shape, stable channel without bed and bank erosion using the following methods:-

i) Permissible velocity method

[13 Marks]

ii) Critical shear stress method

[12 Marks]

…6/-

APPENDIX A / LAMPIRAN A

$$PSD = \frac{a - \sqrt{a^2 - 4b}}{2}$$

$$a = \left(4\frac{Q_a}{t_c}\right)\left(0.333t_c\frac{Q_p}{Qa} + 0.75t_c + 0.25t_{cs}\right)$$

$$b = 4Q_aQ_p$$

$$SSR = 0.06t_d(Q_d - c - d)$$

$$c = 0.875PSD\left(1 - 0.459\frac{PSD}{Q_d}\right)$$

$$d = 0.214\frac{PSD^2}{Q_d}$$

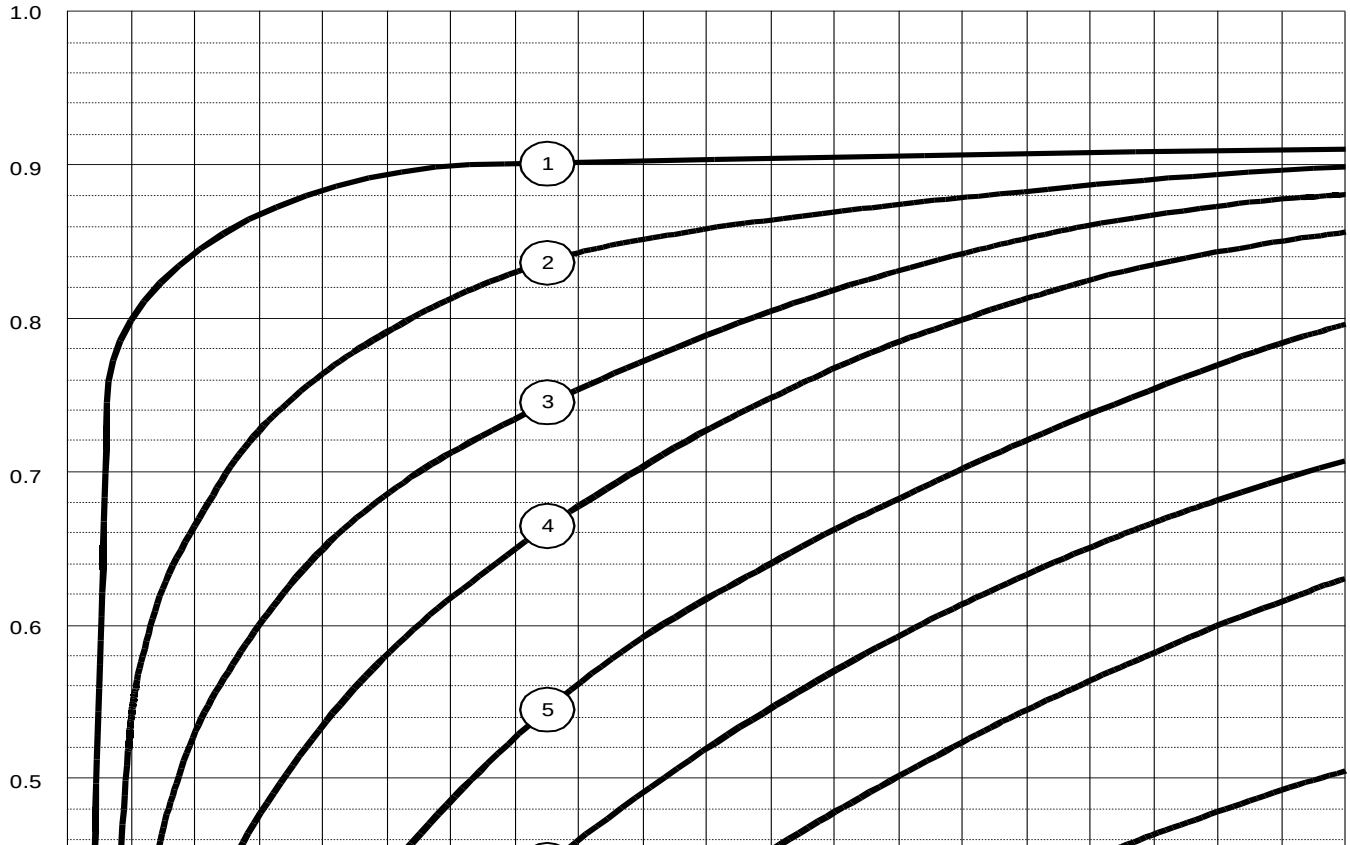
$$\ln({}^{R}I_t) = a + b\ln(t) + c(\ln(t))^2 + d(\ln(t))^3$$

Coefficients of the Fitted IDF Equation for Penang

ARI (years)	a	b	c	d
2	4.5140	0.6729	-0.2311	0.0118
5	3.9599	1.1284	-0.3240	0.0180
10	3.7277	1.4393	-0.4023	0.0241
20	3.3255	1.7689	-0.4703	0.0286
50	2.8429	2.1456	-0.5469	0.0335
100	2.7512	2.2417	-0.5610	0.0341

APPENDIX B / LAMPIRAN B

The Runoff Coefficient for Urban Catchment



(TERJEMAHAN)

1. a) *Definisikan atau terangkan dengan ringkas perkara berikut;*
   i) Pengairan
   ii) Kualiti pengairan
   iii) Keperluan air tanaman
   iv) Keuntungan-keuntungan pengairan

[8 Markah]

b) *Nilai penggunaan konsumtif bulanan untuk padi di jadual dalam Jadual 1. Hitung penggunaan konsumtif. Tentukan purata bulanan penggunaan konsumtif dan tentukan puncak penggunaan konsumtif bulanan?*

Jadual 1

Dates	*Rice* C_u *in cm*
June 1-30	*26.69*
July 1-12	*8.76*
July 13-31	*14.38*
August 1-31	*22.73*
September 1-30	*21.29*
October 1-31	*25.50*
November 1-24	*15.06*

[9 Markah]

c) *Terangkan kebarangkalian penyebab kehilangan air dalam sistem saliran pengairan? Jelaskan juga kaedah yang patut untuk mengurangi kehilangan air tersebut?*

[8 Markah]

2. *Sebuah rumah kediaman bunglo akan dibangunkan di suatu kawasan seluas 900 m^2 di Tanjung Bungah, Pulau Pinang. Kemudahan OSD di atas permukaan tanah dicadangkan untuk disediakan pada kawasan lanskap di hadapan rumah kediaman tersebut. Storan akan dibina dengan mengorek permukaan tanah dan tembok bata digunakan pada bahagian depan dan sisi storan tersebut. Struktur alur keluar terdiri dari orifis dan empang limpah puncak lebar. Keadaan tapak lot bunglo sebelum pembangunan adalah taman berumput. Air larian permukaan mengalir masuk ke dalam OSD melalui longkang perimeter dari kawasan lot bunglo seperti berikut :*

Bunglo Kediaman	*= 300 m^2*
Garaj	*= 45 m^2*
Laluan Masuk berturap	*= 45 m^2*
Laluan & Permukaan Berturap	*= 55 m^2*
Kawasan Lanskap & Taman	*= 455 m^2*

Untuk memenuhi kawalan kuantiti air ribut tentukan perkara berikut :

i) Puncak kadaralir pra-pembangunan
ii) Puncak kadaralir pasca – pembangunan
iii) Aliran keluar dari tapak yang dibenarkan (PSD)
iv) Isipadu OSD yang diperlukan.

Nota: Anggapkan perkara berikut untuk pengiraan: t_c = 45 minutes, t_{cs} = 30 minutes, t_d = 30 minute, C_d = 0.62 and C_{BCW} = 1.70.

[25 markah]

3. a) *Jelaskan **TIGA (3)** jenis storan yang terdiri dari: storan di tapak (OSD); storan komuniti; dan storan regional.*

[5 markah]

b) *Bincangkan dan jelaskan berkenaan dengan konsep MSMA tentang kawalan dari aspek kuantiti dan kualiti.*

[10 markah]

…8/-

c) *Lengkung luas-masa pasca pembangunan dan hujan rekabentuk (50 tahun ARI) untuk suatu kawasan seluas 20 hektar dengan masa penumpuan (pasca pembangunan) 30 minit diberikan dalam jadual di bawah. Anggarkan hidrograf pasca pembangunan untuk kawasan pembangunan tersebut.*

[10 markah]

Isohiet Hujan Rekabentuk (50 tahun ARI)

Masa (min)	***Hujan (mm)***	***Kehilangan (mm)***
5	*18.0*	*5.0*
10	*25.0*	*2.5*
15	*30.0*	*2.5*
20	*32.5*	*2.5*
25	*20.0*	*2.5*
30	*16.0*	*2.5*

Lengkung Luas-masa (Luas Kumulatif)

Luas (m^2)	***Masa (min)***

26000	*5*
56000	*10*
106000	*15*
146000	*20*
176000	*25*
200000	*30*

4. *a) Bincang matlamat perancangan sumber air*

[5 Markah]

b) Terangkan istilah-istilah perancangan sumber air berikut:

i) Matlamat dan objektif-objektif
ii) Polisi
iii) Prinsip-prinsip
iv) Piawai
v) Garis panduan

[5 Markah]

…9/-

c) Berbantukan rajah, apakah yang dimaksudkan pengurusan sumber air khusus untuk bekalan air?

[5 Markah]

d) Bincang peranan pemodelan kualiti air dalam sumber air.

[5 Markah]

e) Untuk sebuah projek sumber air, kajian kebolemungkinan adalah penting untuk menilai pelbagai alternate projek. Nyatakan ciri-ciri penting laporan kajian kebolehkemungkinan tersebut.

[5 Markah]

5. *Diberi ciri-ciri berikut:-*

Q	$= 96\ m^3/s$	Z	$= 2\ m$
D_{50}	$= 40\ mm$	S_0	$= 2.06 \times 10^{-3}$
θ	$= 37^0$	V_c	$= 1.8\ m/s$

Andaikan K = 0.67, rekabentuk satu saluran stabil tanpa berlakunya hakisan dasar dan tebing berbentuk trapezoid dengan menggunakan kaedah berikut:-

i) Kaedah halaju dibenarkan

[13 Markah]

ii) Kaedah tegasan ricih kritikal

[12 Markah]

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